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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/640,519	08/17/2000	Hiroaki Nakaoka	0819-408	6287

7590

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EXAMINER

VU, DAVID

ART UNIT

PAPER NUMBER

2818

DATE MAILED: 06/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/640,519

Applicant(s)

NAKAOKA ET AL.

Examiner

DAVID VU

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05/09/03.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 and 6-10 is/are pending in the application.
- 4a) Of the above claim(s) 5 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 6-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 August 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1-2, 4 and 6-8 are rejected under 35 U.S.C. 103(a) as being anticipated by Kwong et al (US 5,541,436) in view of Hori et al. (US 6,215,163)

Regarding claim 1, Kwong et al, in related text (Col. 3, Lines. 7-42) and figures (Figs. 1-2) disclose a method of fabricating a semiconductor device, the method comprising the steps of (a) forming a silicon oxynitride film 20 on a substrate 10; (b) performing a heat treatment while keep the surface of the silicon oxynitride film 20 in contact with a gas containing nitrogen ;(c) after step (b), forming a semiconductor film 18 containing an impurity of first conductivity type on silicon oxynitride film 20; (d) after step (c), forming a gate electrode 18 composed of the semiconductor film 18 by patterning the polysilicon layer 18; (e) after step (d), forming a gate insulating film composed of SiON film 20 by patterning the SiON film 20.

Kwong et al. lacks the technique scope of introducing nitrogen into the SiON film using a gas containing nitrogen and oxygen.

Hori et al., in related text disclose the step of performing a heat treatment while keep the surface of the silicon oxynitride film 14 in contact with a gas containing nitrogen and oxygen to

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introduce nitrogen into the silicon oxynitride film. By using Hori et al. method, this silicon oxynitride film 14 has a nitrogen concentration peak formed at around the center portion (Col. 7, Lines 20-33 and Col. 7, Line 56-Col. 8, Line 3). It would have been obvious to one of ordinary skill in the art at the time the invention was made for thermally grow the SiON layer on silicon substrate as taught by Hori et al in the Kwong et al. process because this process provides precise thickness control, improved interface structure, low density electron traps, and impedes dopant impurity diffusion from/to the dielectric and substrate.

In re claim 2, Hori et al., in related text disclose the SiON film is formed by apply N₂O gas and performing the heat treatment to the surface of the silicon substrate (Col. 5, Lines 17-22).

In re claim 4, Hori et al., in related text disclose the heat treatment is performed at 900°C to introduce nitrogen into the SiON film (Col. 9, Lines 1-6)

In re claims 6-7, Hori et al., in related text disclose an NO/N₂O gas is used as the gas containing nitrogen to introduce nitrogen into the SiON film (Col. 7, Lines 20-33)

In re claim 8, Kwong et al disclose wherein the semiconductor device is a p-channel MIS transistor and a silicon film for a gate electrode containing boron is formed as the semiconductor film in step(c) (Col. 3, Lines. 43-59).

2. Claim 3 is rejected under 35 U.S.C. 103(a) as being anticipated by Kwong et al (US 5,541,436) in view of Hori et al. (US 6,215,163) and further in view of Shue et al. (US 6,380,056).

Kwong et al. and Hori et al, disclose all claimed subject matter, but omits the forming of amorphous silicon film. Shue et al., in related text disclose an amorphous silicon film on the SiON film, implanting impurity ions into the amorphous silicon film and performing a heat treatment for activating the impurity to change the amorphous film into a polysilicon film (Col. 6, Lines. 14-35 and Col. 2, Lines. 48-61). It would have been obvious to one of ordinary skill in the art at the time the invention was made for forming an amorphous silicon film since the amorphous silicon gate has fewer stress induced defects reducing leakage paths that contribute to unacceptable voltage threshold levels and hence improving reliability.

3. Claim 9 is rejected under 35 U.S.C. 103(a) as being anticipated by Kwong et al (US 5,541,436) in view of Hori et al. (US 6,215,163) and further in view of Chang et al. (US 5,817,562).

Kwong et al. and Hori et al, disclose all claimed subject matter, but omits the protecting layer. Chang et al., in related text (Col. 5, Lines. 45-54) and figure (Fig. 2a) disclose the step of forming a SiO₂ layer on the gate electrode. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a silicon dioxide film to form the stacked gate electrode structure and to protect the polysilicon underlayer.

4. Claim 10 is rejected under 35 U.S.C. 103(a) as being anticipated by Kwong et al (US 5,541,436) in view of Hori et al. (US 6,215,163) and further in view of Gupta et al. (US 6,391,732).

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Kwong et al. and Hori et al, disclose all claimed subject matter, but omits the L-shape spacers.

Gupta et al., in related text and figure (Figs. 5-7) disclose the first side wall with a L-shape cross section view is formed on the sides of the gate electrode and a second side wall that spreads over the side and base of the first side wall. It would have been obvious to one of ordinary skill in the art at the time the invention was made for forming the self aligned L-shaped sidewall spacers as taught by Gupta et al. The L-shape space is formed to prevent outdiffusion of impurities from substrate and to assist in prevention of bridging in the event of silicide formation.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Vu whose telephone number is (703) 305-0391. The examiner can normally be reached on Monday-Friday from 8:00am to 5:00pm.

If attempt to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms., can be reached on (703)308-4910.

DV

David Vu



HOAI HO
PRIMARY EXAMINER